

6. The system of claim 1, wherein the plurality of capture molecules are arranged as an array including at least two reaction sites, each of the at least two reaction sites being formed by printing a composition onto the planar surface, the composition comprising at least one of the capture molecules.

7. The system of claim 6, wherein the at least two reaction sites contain different compositions.

8. The system of claim 6, wherein the at least two reaction sites include capture molecules selected from the group consisting of HIV antigens p17, p24, p31, gp41, p51, p55, p66, gp120, gp160, p41 Type O, p36 of HIV-2, antibodies against HIV antigen p24, and combinations thereof.

9. The system of claim 1, wherein the reader instrument further comprises a beam homogenizer.

10. A method for performing an assay on a sample, the method comprising:

providing a cartridge, which cartridge includes

a planar waveguide having a plurality of capture molecules bound to a planar surface thereof,

a refractive volume for optically coupling a light beam provided by a light source to the planar waveguide, the refractive volume being integrally formed from the planar waveguide, and

a sample chamber for receiving and containing the sample such that the sample comes into contact with the plurality of capture molecules;

introducing the sample into the sample chamber of the cartridge;

providing a reader instrument, which reader instrument includes

a receiving mechanism for positioning the cartridge therein,

the light source for providing the light beam,

a detector for detecting a light signal from a portion of the planar surface on which the plurality of capture molecules is bound, and

an analysis module for receiving and analyzing the light signal from the detector;

inserting the cartridge, containing the sample, into the reader instrument;

using the light source, illuminating a portion of the planar waveguide at which the plurality of capture molecules are bound such that, if the sample includes a target analyte, the target analyte interacts with the plurality of capture molecules so as to produce a light signal;

capturing the light signal; and

analyzing the light signal,

wherein illuminating includes

directing the light beam at the refractive volume such that the light beam is incident on the refractive volume in a plane parallel to and offset from the planar waveguide, and

refracting the light beam such that the light beam is focused at the planar surface at a non-zero, internal propagation angle relative to the planar surface for all light within the light beam.

11. The method of claim 10, wherein the plurality of capture molecules include at least one molecule selected from the group consisting of a peptide, a polypeptide, a protein, an antibody, an antigen, a polysaccharide, sugar, an oligonucleotide, a polynucleotide, a synthetic molecule, an inorganic molecule, an organic molecule, and combinations thereof.

12. The method of claim 10, further comprising modifying the planar surface using a process selected from the group

consisting of plasma activation, chemical vapor deposition, liquid phase deposition, and surface polymerization of an activation chemistry, and combinations thereof.

13. The method of claim 10, the sample containing an antibody and an antigen, the method further comprising detecting both the antibody and the antigen in the sample.

14. The method of claim 13, wherein the plurality of capture molecules are selected from the group consisting of HIV antigens p17, p24, p31, gp41, p51, p55, p66, gp120, gp160, p41 Type O, p36 of HIV-2, antibodies against HIV antigen p24, and combinations thereof.

15. The method of claim 10, wherein providing the reader instrument further comprising homogenizing the light beam before the light beam is optically coupled to the planar waveguide.

16. A kit for performing a biochemical assay on a sample, the kit comprising:

a cartridge including

a planar waveguide having a plurality of capture molecules bound to a planar surface thereof,

a refractive volume for optically coupling a light beam provided by a light source to the planar waveguide, the refractive volume being integrally formed from the planar waveguide, and

a sample chamber for receiving and containing the sample such that the sample comes into contact with the plurality of capture molecules;

a reader instrument including:

a receiving mechanism for positioning the cartridge therein,

the light source for providing the light beam,

a detector for detecting a light signal from a portion of the planar surface on which the plurality of capture molecules is bound, and

an analysis module for receiving and analyzing the light signal from the detector; and

one or more processing solutions,

wherein the cartridge and the reader instrument cooperate such that the light beam is incident on the refractive volume in a plane parallel to and offset from the planar waveguide, and the light beam is focused at the planar surface at a non-zero, internal propagation angle relative to the planar surface for all light within the light beam, while illuminating a portion of the planar waveguide including the plurality of capture molecules thereby, if the sample includes a target analyte, the target analyte interacts with the plurality of capture molecules so as to produce the light signal capturable by the detector.

17. The kit of claim 16, wherein the one or more processing solutions is selected from a group consisting of sample diluents solution, fluorescent conjugate solution, and wash solution.

18. The kit of claim 16, wherein the plurality of capture molecules include at least one molecule selected from the group consisting of a peptide, a polypeptide, a protein, an antibody, an antigen, a polysaccharide, sugar, an oligonucleotide, a polynucleotide, a synthetic molecule, an inorganic molecule, an organic molecule, and combinations thereof.

19. The kit of claim 16, wherein the planar waveguide is formed of an optically transparent material selected from the group consisting of cyclic olefin polymer, cyclic olefin copolymer, polyolefin, polystyrene, acrylic, polymethylmethacrylate, and polycarbonate.

20. The kit of claim 16, the sample containing an antibody and an antigen, and wherein the cartridge and the reader instrument are configured to cooperate so as to detect both the antibody and the antigen in the sample.